APPENDIX 1
KENTUCKY HAZARD ANALYSIS

A study of actual and potential hazards in Kentucky shows that no county, city, town or village is immune to disaster. The threat of accidents and natural disasters is a common concern to the citizens of Kentucky. The vulnerability, or hazard threat, varies according to region and community by season, and type of disaster.

During a calendar year, public hazards that concern most local officials change in priority. Although many hazards are continuous (earthquakes, landslides, transportation accidents, and human action emergencies) others vary according to seasonal and climatic factors.

The following hazards, or threats, have been identified for the State:

1. Floods
2. Tornadoes
3. Severe Weather
   a. Remnants of Hurricanes or Tropical Storms
   b. Thunderstorms (and related phenomena)
   c. Winter Storms (ice and snow)
   d. Hail Storms
4. Earthquakes
5. Forest Fires/Wild Fires
6. Landslides
7. Subsidence
   a. Mine
   b. Karsts/Sinkholes
8. Transportation Accidents
9. Energy-Related Hazards (and Power Shortages /Outages)
10. Water Shortages/Droughts
11. Nuclear/Conventional/WMD/Terrorist Attack
12. Dam Failure
13. Drought
14. Animal/Plant Diseases
15. Epidemiological Outbreak

Following is a brief summary of the factors and conditions that influence the incidence of these various types of hazards, and the vulnerability of our State to each of them. Greater detail will be found in the “Kentucky State Hazard Mitigation Plan – November 2004”
Published by the University of Louisville and KyEM.

<u>FLOODS:</u>

Floods are probably the most common hazard to affect the State. Major flooding occurs within the state almost every year, and usually there are several floods within the course of a year. Significant floods occurred in 1973, 1975, 1977, 1978, 1979, 1982, 1984,

1989, 1991, 1997, 2001, 2002 and 2003.

Two types of flooding have been identified: Flash Floods and River Basin Floods.

Flash Flooding has occurred in all parts of the state as the result of excessive rainfall over short periods of time. This type of flooding is more prevalent, however, in eastern Kentucky, where its incidence is abetted by the region's mountainous terrain and the many narrow gorges and riverbeds.

Flash floods have occurred in all months of the year, but they are more prevalent during spring and summer months.

River Basin Flooding is more common during winter and early spring - February to April. Flooding of this nature is common along Kentucky's major streams, particularly along the Ohio, Mississippi, Licking, Big Sandy, Cumberland, Green, Rolling Fork and Kentucky Rivers, along with other smaller streams. Cities such as Frankfort, Louisville, Owensboro, Paducah Hazard, Prestonsburg, Lebanon Junction and New Haven have been seriously affected by past flooding. Every two to three years serious flooding occurs along one or more of Kentucky's major streams, and it is to unusual for this to occur several years in succession.

TORNADOES:

Tornadoes may occur in any part of the state at any time of year. However, the western and central portions have been more frequently struck, and the months of March, April and May seem to have the most severe tornadoes. Tornadoes have been recorded in the state as far back as 1830, but they seem to have become more frequent in recent years.

Since 1950, there has been an annual average of 8.4 tornadoes in Kentucky. There were 19 tornadoes reported in 1973; in 1974 there were a total of 34.

Injuries, damages and fatalities attributed to tornadoes have also been on the increase in recent years. In 1971 there were 9 deaths and some 130 injuries from tornadoes; in 1974 there were 76 tornado fatalities and approximately 1,000 personal injuries from the exceptionally high number of tornadoes that affected the State that year.

SEVERE WEATHER:

This topic includes several locally severe weather phenomena.

Hurricanes:

Kentucky does not lie within the hurricane zone of the U.S.; however, hurricanes frequently follow a northeasterly path that takes them across our state. These passing "cyclones" may produce excessively heavy amounts of rainfall, resulting in flash flooding for various communities in the state; or they may spawn deadly tornadoes, which wreak death and destruction on the state's inhabitants. Probably the most damaging - and best known - incidence of such hurricane -

spawned tornadoes occurred on Palm Sunday, 1965, across several states of the Midwest, including Kentucky.

Thunderstorms:

Thunderstorms are quite frequent in our state. They normally produce little damage and few, if any, fatalities; however, a severe thunderstorm may be accompanied by strong winds, hail or other phenomena, which can produce considerable damage to buildings and crops.

Hailstorms cause more dollar damage than any other type of windstorm.

Lightning is the most deadly phenomenon associated with thunderstorms, resulting in numerous deaths each year.

Additionally, thunderstorm conditions favor the formation of tornadoes, adding significantly to the hazard potential of these locally severe storms. Due to the close relationship of thunderstorms with tornadoes, thunderstorm warnings have acquired a special significance in our State, especially if they come in the mid-to-late afternoon.

Winter Storms:

Due to its mild, temperate climate, our State has experienced few severe winter storms. Occasionally, ice and/or snowstorms do occur, but they are commonly light and of short duration. Rarely does snow accumulate to depths greater that three (3) or four (4) inches. Our most severe winter weather conditions normally occur during the months of January and February; eastern Kentucky is more often affected by these severe weather factors than other parts of the State. The most severe recent winters occurred in 1976-77, 1977-78, 1978-79 and 1993-94, while record low temperatures were reached in the winter of 1983-84, 1984-85 and 1993-94. During the winter of 2004/2005 isolated snow and ice storms hampered transportation movement over Kentucky's highways.

EARTHQUAKES:

Kentucky has not experienced an earthquake of major proportions since 1812. However, this violent form of natural disaster poses a great hazard to certain regions of the State, in particular the Jackson Purchase region and the extreme southeastern section of the state.

Geologic faulting in the Jackson Purchase region makes this a high "seismic risk" zone, with the potential for an earthquake which could literally wipe out certain of the region's urban centers, and quite probably produce considerable damage to other areas of the State. An earthquake on the scale of the New Madrid Quakes of 1811-1812 (a Modified Mercalli Scale of VII or VIII) can be projected to cause damage as far away as Louisville and Lexington.

There have been numerous tremors over the years, to serve as reminders of this threat, while a significant earthquake occurred in north-central Kentucky in 1980.

Any major earthquake is expected cause other problems such as releases of Hazardous Materials, Dam Failures, Road and Bridge Failure and Debris Management.

FOREST FIRES/WILD FIRES:
The chief hazard, or threat, of forest fires in Kentucky exists in the eastern part of the State. This is due to the extensively forested areas in the region and the poor accessibility of many areas, making fire suppression more difficult.

A fire threat does exist for other areas of the state (all but seven of the State's 120 counties have reported fires of some magnitude within the past few years); however, the State, as a whole, has had a fairly good wildfire record. There has been no major fire (affecting as much as 5,000 acres) in the past decade.

The fire hazard is at its zenith during prolonged periods of drought, or at times of increased incendiary activity (trash and field burning etc.). The peak "fire seasons" in Kentucky occur in the spring and fall.

LANDSLIDES:
Landslides have been a common hazard in the past. Various landslide-prone areas have been identified throughout the state. Eastern Kentucky has had a long history of landslides, particularly in the Pine Mountain region.

Other areas where landslides has been problematic in recent years are: (1) Northern Kentucky: Boone, Kenton and Campbell counties primarily along the Ohio River (2) Parts of Northeastern Kentucky: Bath, Rowan and Carter counties; (3) Central Kentucky: Nelson and Hardin counties; and, (4) Western Kentucky, along the tradewater, particularly in Grayson and Caldwell counties.

SUBSIDENCE:
Subsidence, or land settlement, has been problematic in many parts of western and south-central Kentucky, particularly in the Mississippian Plateau region, where the combination of loose soils, soft limestone, and heavy precipitation have resulted in "cave-ins" and "sinkholes" throughout the area-producing "karsts topography". Damage has been limited primarily to roadways and gas and sewer mains; however, buildings are occasionally damaged and have to be reinforced, or relocated to firmer grounds.

TRANSPORTATION ACCIDENTS:
These are one of the constant hazards to affect our state. They occur daily, throughout the State. They most commonly take the form of motor vehicle collisions involving two or more cars, objects, or persons. These account for 99% of all transportation accidents and 90% of all fatalities.

Rail accidents represent a portion of these accidents. Rail accidents have the potential to become major incidents. Air and water accidents are less frequent, but they do occur.

The most serious threat from a transportation accident arises when chemicals or other

hazardous materials are involved. These have the potential of affecting great numbers of people, over large distances. This hazard potential is most serious in the state's metropolitan areas, (e.g. Louisville, Covington, Ashland, Paducah, Lexington, etc.) due to the number of people who might be affected.

ENERGY HAZARDS:

Petroleum and Natural Gas:
The movement and flow of energy (primarily petroleum and natural gas) throughout our State present us with several potentially hazardous situations. Most of these are concerned with transportation of natural gas and petroleum products across the State. The hazard threat produced by accidental rupture of a gas-laden tank truck or rail car, or a petroleum-laden barge is considerable, particularly in the State's urban areas where the potential for such accidents is high and where greater numbers of people are likely to be involved.

Other hazardous situations arise from possible rupture of the many pipelines and gas lines that crisscross the State. Accidental rupture of these can result in fire, explosion or both, resulting in property damage and possible injuries or loss of life to inhabitants. Another major hazard involves the accident potential within refineries and storage areas. The potential is especially great for fires and explosions in these areas where careless handling or improper use of fire can produce catastrophic accidents.

Thus far, the natural gas and petroleum related industries operating in Kentucky have had an excellent safety record, and the State has not experienced major fires or explosions of this nature, but the potential remains and will require very close attention to those communities having concentrations of these industries or storage areas, within or in approximately to their borders.

ELECTRICAL HAZARDS:
Electrical transmission within the State creates some additional energy hazards. Rupture or breakage of transmission lines is probably the most common hazard; this may result in structural fires or loss of life. Additionally, death or injury from electrocution can result.

Probably the greatest hazard is associated with electrical generation arising from the release of environmentally polluting combustion products and large quantities of heat that must be disposed of. These waste products possess the potential for contamination of a community's water supply and atmospheric pollution. They may post a threat to the State's wildlife and natural resources, as well as to the health and well-being of its inhabitants.

Power Shortages/Outages:
Due to the current restrictions on energy nationwide, the possibility of power shortages or outages in our state has become a real threat. These can occur throughout the State; however, metropolitan areas would be more seriously affected simply because more people would be involved. Energy allocation

plans, in the event of a severe shortage or outage, will have to take this into account.

DROUGHT/WATER SHORTAGES:
Due to the State's ample water resources (surface and ground water), it rarely experiences severe periods of drought or water shortage.

Occasionally, drought conditions do occur in the State, but they are usually regional and short-lived. Water shortages affecting city water supplies occur frequently during summer months, usually in areas served by reservoirs or wells. Often they happen due to equipment failure or contamination.

TERRORISM/WAR
According to the U.S. Department of Defense and the Department of Homeland Security various facilities that might be targets for enemies of the United States have been identified.

Possible targets in Kentucky include transportation corridors, communications systems, historical sites, government centers, industrial plants and agricultural production sites.

DAM FAILURE
While Kentucky has numerous dams that are owned by both governments and private individuals, and constructed of concrete, earth, or a mixture of these two, all recorded dam failures have involved private earthen dams. These dams normally fail due to a severe rain that causes the water contained by the dam to flow over the dam and eat away the earthen embankment, leading to loss of the integrity of the dam face. These failed earthen dams generally hold back mine run off waters.

ANIMAL DISEASES
In 2002 and 2005 the thoroughbred horse industry had quarantines placed on movement of horses due to disease outbreaks within portions of the horse herd.

EPIDEMIOLOGICAL OUTBREAK
Kentucky, throughout its history, has experienced epidemiological outbreaks of various diseases that have killed its citizens. These diseases have included flue, small pox, tuberculosis, AIDS, cholera, polio, typhus, and others. During the winter of 1917/1918 numerous Kentuckians died of the Spanish Flue. Throughout the 1980s and 1990s flue outbreaks have closed schools, filled hospitals, and killed the elderly and sick.

POPULATION ANALYSIS: SUMMARY
Population wise, the hazard potential for most types of disasters is greatest for the state's metropolitan areas - simply because more people would likely be affected in the event of a disaster. This is not to say that these areas are necessarily more likely to be stricken by disaster than rural areas, although certain factors and conditions do make urban centers more prone to certain types of hazards. For example, flooding has been a serious problem for most of the state' urban centers since most of them have developed partially or totally in low-lying areas near major streams, with little regard to existing flood plains.

An unusually high percentage of transportation accidents seem to occur in the state's urban areas, where the potential for major disaster is greatest. Explosions (chemical, gas, industrial, etc.) and chemical leaks or spillage are most likely to occur in the metropolitan areas due to the heavy concentration of plants and transportation facilities in or near these areas.

Human-related emergencies (resulting from accidents, fires, explosions, etc.) would also be more likely to occur in the larger urban areas as a result of transportation and industrial concentrations, or extreme smog conditions. Mass poisonings, epidemics, and water pollution threats would also be greatest for these centers; urban centers would also be most susceptible to power and water shortages/outages.

Other disasters, such as tornadoes, thunderstorms, earthquakes, etc., usually occur without regard to urban-rural classifications; however, their hazard potential is much greater when they strike urban areas. Forest fires, or wildfires, are more likely to occur in rural areas; these generally do not affect large numbers of people.